

Smart 2500W Shunt Regulator



The SR5K100V25R Shunt Regulator has been designed to work in conjunction with a wide variety of power sources and motor controllers. Over voltage shunting may be required when braking or drastically reducing DC motor speeds which creates Back Electro-Motive Force (EMF), or Regeneration and is used to prevent damage to the power supply and associated electronics. This voltage can equal to or even exceed the supply voltage in some cases depending on the rotational inertia of the mechanical system, causing system failures or permanent damage. The Roboteq SR5K100V25R Shunt Regulator applies a heavy two-level resistive load during overvoltage conditions to bring voltages back to safe levels.

Applications

- Automatic Guided Vehicles
- Small Electric Vehicles, Electric Bikes
- Police and Military Robots
- Hazardous Material Handling Robots
- Automated Delivery Robots
- Motorized Factory Machinery

Standard Features

- Dissipates Excess EMF and Regeneration voltage to prevent system failure or damage.
- Simple on-the-fly adjustment of nine preset shunt voltages.
- Full Auto shunt threshold set for a full range of voltages from 12 to 100 volts.
- Over heating protection can be cycled repeatedly without replacing an inline fuse or circuit breaker.
- Fast easy connection to unit using Fast-On type connectors and standard crimp style lugs.
- Voltage loop through connections makes the use of "Y" cables unnecessary.
- Solid 6061 aluminum base plate for easy mounting and superb heatsinking.
- 5000 Watt instantaneous, 200 Watts continuous load capability.
- Flashing Status Lamp to indicate the operational mode including Scan, Relay ON, and Resistor Cooling modes.
- Active relay switching indication lamps during shunting operation.
- Compact, Low Cost with Simple Operation.

Ordering Information

Reference	Channels	Watts	Volts	Presets	Max Load R
SR5K100V25R	1	200	100	10	2.5 Ohm

Operation

The Shunt Regulator is connected across the DC power source to the operating electronics. It then monitors the line continuously, and when the voltage exceeds the clipping preset the microcontroller activates the switching which connects the shunt resistor across the load. For the time that the measured voltage exceeds the preset value, the shunt remains connected. When the voltage levels drop to a level just below the threshold value minus a preset hysteresis loop value, the shunt disconnects. Constant monitoring of the shunt resistor temperature ensures that long term shunting does not exceed the thermal limits of the two 100W load resistors. To ensure that the proper braking load is applied at the correct time, the Shunt Regulator uses a Dual Resistor configuration. As the voltage rises, the first 100W load resistor is made active, then the second resistor about 3 volts higher. This allow more accurate control of the overvoltage condition.

Roboteq Voltage Shunt Regulator Concept Block Diagram

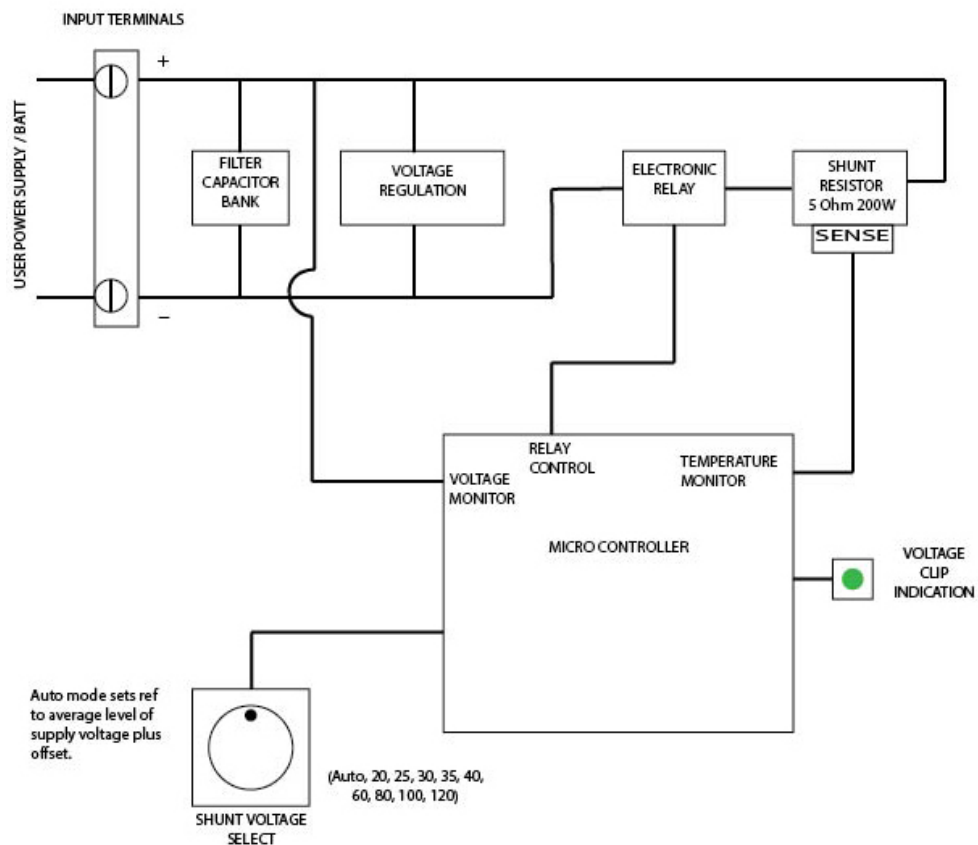


FIGURE 1. Block Diagram of Shunt Regulator Assembly

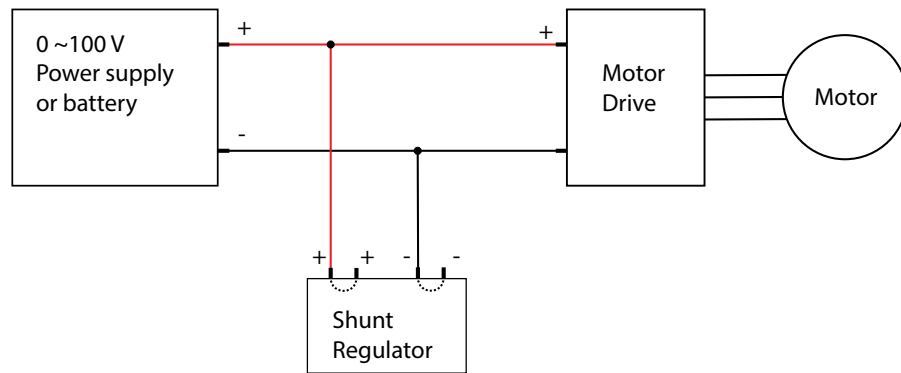


FIGURE 2. General Connection Diagram

The connection to the shunt regulator is illustrated in figure 2. Please note that if the auxiliary power connectors are used, the motor drive's current will constantly flow through the fast-on connectors. Use the connection illustrated in Figure 3 only if you can guarantee that the application's current remains below 40 A, which is the maximum rating for the fast-on connectors.

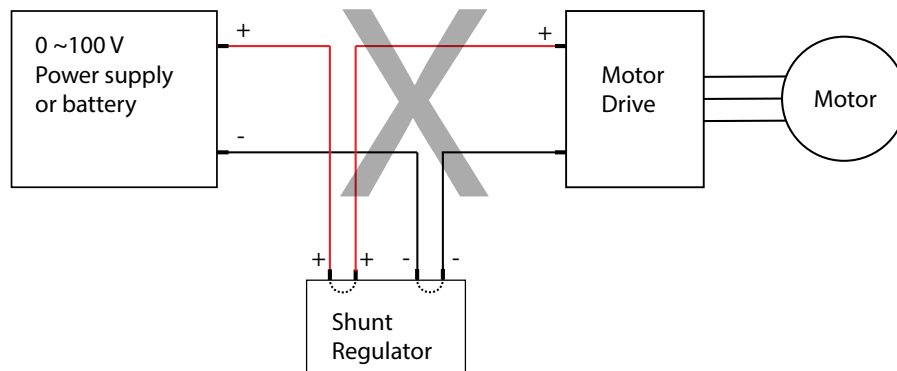


FIGURE 3. Improper connection example

Compatibility with other Roboteq products

The SRV100 Shunt Regulator module is fully compatible with all Roboteq motor controllers which include both brushed and brushless types. Loop through connections on the Shunt Regulator allow for easy power pass through connections.

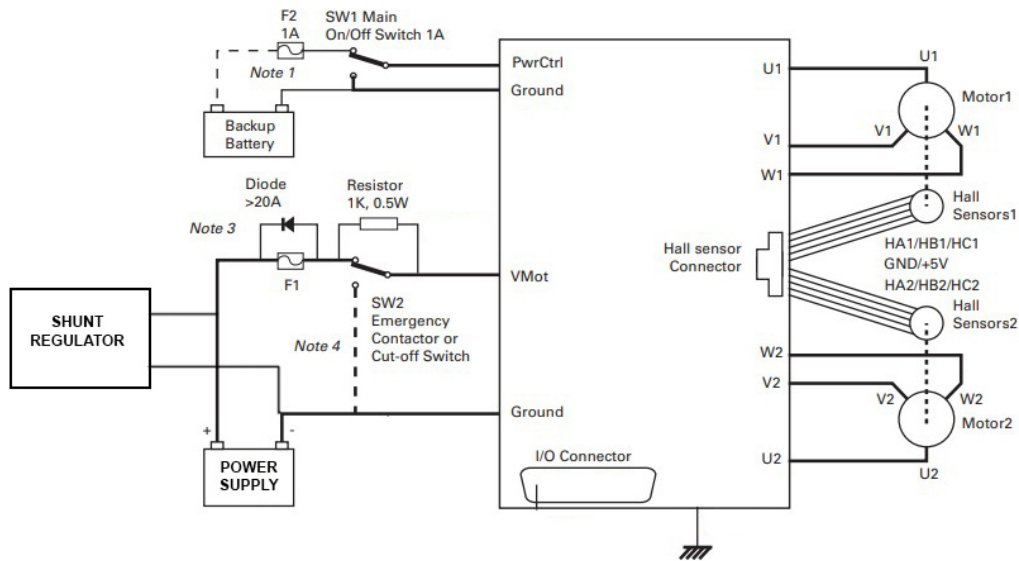


FIGURE 4. Typical wiring with Roboteq controller

Operation

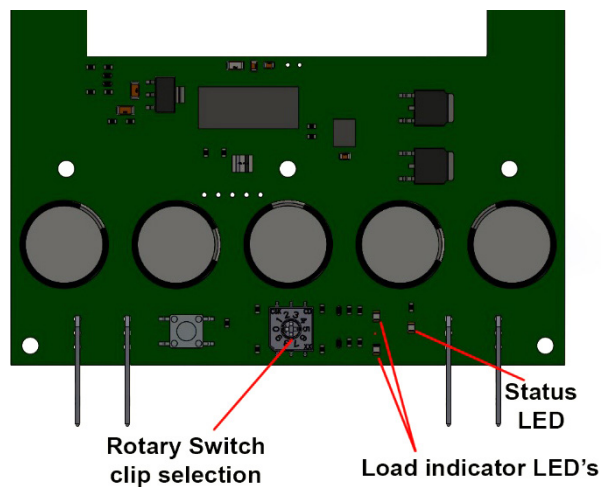


FIGURE 5. Location of indicator lamps and Rotary switch

Upon power up the STATUS LED's will remain off for 3 seconds. During the initial power up delay, the input voltage applied across the Shunt Regulator is measured and evaluated. The AUTO mode value is set. The controller then goes into SCAN mode, ready to activate the load if an overvoltage condition occurs. The STATUS LED flashes twice a second during SCAN mode when there is no overload and conditions are nominal.

When an over voltage condition occurs, the STATUS LED extinguishes and one or both of the load switches becomes active, with the corresponding LOAD LED illuminated depending on whether one or both shunt loads are active. These will stay lit during the overvoltage condition as long as the resistors do not exceed their power rating. If the duration of the over voltage causes a thermal overload condition in the load resistors (about 70C), the controller automatically turns off the loads to prevent damage to the Shunt Regulators electronics. Both LOAD LED's will then turn off, and the STATUS LED will show a fast double flash spaced at one second intervals to indicate the unit is in the COOLDOWN mode. Depending on heat sink of the base metal plate of the Shunt Regulator, this may take up to a minute or more to recover and the temperature of the 100W load resistors to return to a safe level. The double flash will stop and at that point the loads will be turned back on if needed. If the over load time period calculated by the i2t protection algorithm exceeds the load resistors manufacturers specifications, then loading is also discontinued. The STATUS LED will remain on solid until the time period has elapsed to re-enable loading. Unlike the previous version of the firmware, the user **does not have to hit a reset button** to recover. The controller in the Shunt Regulator will release the load from shutdown after a pre determined period depending on the overload condition and automatically reset and resume scanning operation.

LED Indicator Lamp Summary

Firmware before January 2022

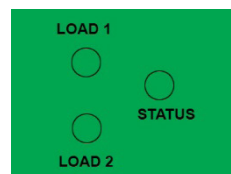


FIGURE 6. All OFF – Power is OFF

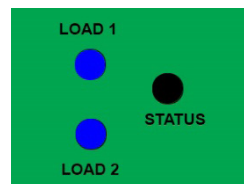


FIGURE 7. Both Loads are Active

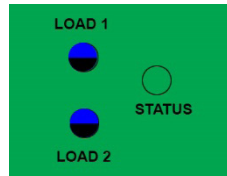


FIGURE 8. Load Alternating – Equivalent to One Load Active

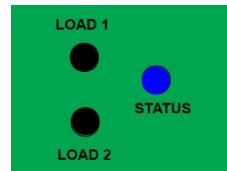


FIGURE 9. Status ON Solid – i2t overvoltage max limit reached, loads cut off

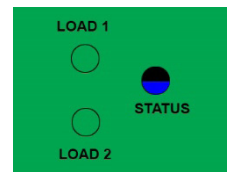


FIGURE 10. Double Flash Status – Thermal Overload

Firmware after January 2022

(All above except “Status ON Solid” has been replaced)

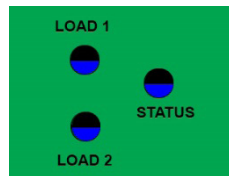


FIGURE 11. All Three Flickering – Overvoltage, trying to re-connect loads.

This replaces the Solid ON condition, which takes longer to attempt loading recovery.

Selecting the Clipping Voltage

Voltage selection is accomplished by setting a rotary PCB mounted switch. The following shunting voltages are preset:

Switch	Clip Voltage
0	AUTO
1	20V
2	25V
3	30V
4	35V
5	40V
6	60V
7	80V
8	100V
9	-

The *preset voltages* for shunting can be set at any time during operation. The selection of a proper shunt clip voltage above the power supply voltage is crucial for proper operation. Standard shunting voltages from 20 volts to 120 volts maximum are available on the switch.

Auto Mode is active when switch position "0" is selected. The processor reads the power line voltage upon power up and sets a fixed preset threshold (about 5v) above that value. This will allow for intermediate values to be obtained for shunting.

Caution

Be aware that if the device is in auto mode and is charging, resistors may connect to the system as the voltage increases. Despite the built-in I2T protection temporarily disconnecting the resistors, repeated cycling can lead to their damage. To prevent this, always switch to manual selection mode if the shunt regulator remains connected during battery charging.

Note: The momentary push button on the status area of the PCB is not currently used and will become available at a future time to implement additional features.

Product Specifications

Electrical Specifications

Absolute Maximum Voltage input range	12 – 120vdc
Typical operating input voltage	20 – 100vdc
Auto Mode input voltage range	12 – 100vdc
Current Consumption at 50vdc	25 ma
Current Consumption at 25vdc	12 ma
Filter Capacitance	1650uF
Maximum Cont. Power Dissipation	200W
Total Load Resistance	2.5 Ohms 200W
SCAN mode Sampling rate	Every 1.0 mS

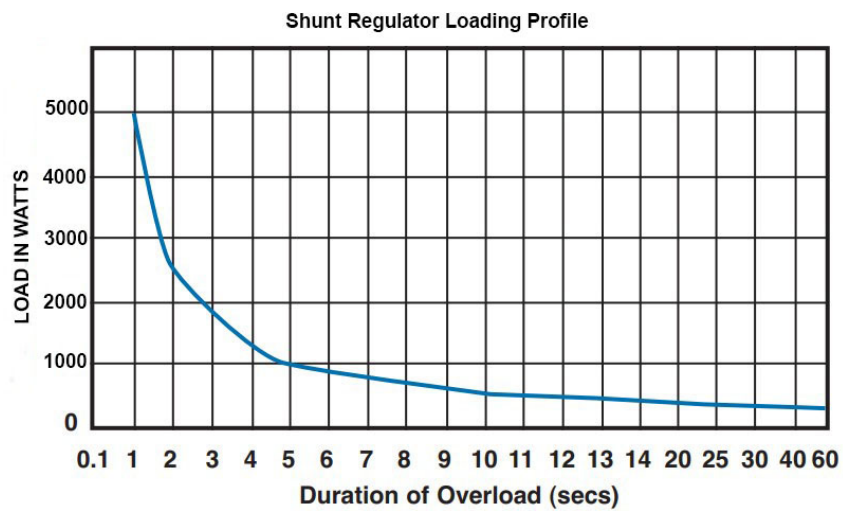


FIGURE 12. Overload vs. Duration for the Shunt Regulator Loading Profile

Max Amperage at various clip level settings

Case 1: Single 5 ohm primary loading

Clip Voltage	Amperage	Watts
20	4	80
30	6	180
40	8	320
50	10	500
60	12	720
70	14	980
80	16	1280
90	18	1620
100	20	2000

Case 2: Dual Load 2.5 ohm loading

Clip Voltage	Amperage	Watts
20	8	160
30	12	360
40	16	640
50	20	1000
60	24	1440
70	28	1960
80	32	2560
90	36	1620
100	40	4000

Mechanical Specifications

Size (H x W x D) 35mm x 100mm x 159mm

Weight 0.54 kg

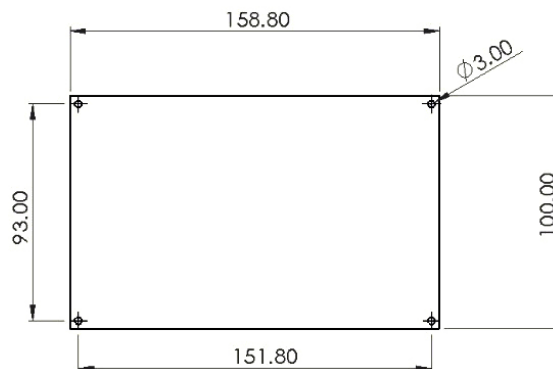


FIGURE 13. Mounting Plate Hole Location